FIVE-YEAR REVIEW REPORT

SECOND FIVE-YEAR REVIEW REPORT
FOR
MARSHALL LANDFILL SITE
Boulder County, Colorado

September 2001

Prepared by:

U.S. Environmental Protection Agency
Region VIII
Denver, Colorado

Approved by: /Signed Max Dodson/ Date: September 28, 2001

Assistant Regional Administrator
U.S. EPA, Region VIII

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TABLES

ATTACHMENTS

LIST OF ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Difference
LGAC	Liquid-phase granular activated carbon
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PCE	Tetrachloroethene
PRP	Potentially Responsible Party
RA	Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
TCE	Trichloroethene
VGAC	Vapor-phase granular activated carbon
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) Region VIII has conducted a second five-year review of the remedial actions implemented at the Marshall Landfill Site (the Site) in Boulder County, Colorado. The purpose of the five-year review is to determine whether the remedy at the site is protective of human health and the environment. The trigger action for this review is completion of the first five-year review in November 1995. Due to the fact that hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unrestricted use and unlimited exposure, another five-year review is required.

The remedy for the Marshall Landfill Site included a groundwater collection and treatment system, landfill improvements and environmental monitoring programs. The remedy was considered operational in 1993. The assessment of this second five-year review is that the remedy is operating consistent with the requirements of the Record of Decision, subsequent Explanation of Significant Difference and the EPA-approved remedy designs. The remedy is progressing as expected, and the concentrations of contaminants in shallow groundwater have been decreasing with time.

A number of issues were identified during this review. Several are minor issues that can be addressed through continued active maintenance of the landfill improvements. Others are minor problems related to reporting surface water and groundwater monitoring results. The PRPs (City of Boulder and Browning-Ferris Industries) should address all of these minor issues to maintain and confirm the ongoing protectiveness of the remedy.

Also at issue is the protection of surface waters originating at the Site. The PRPs should demonstrate, through additional surface water monitoring, that the remedy is protective of surface water quality for all of the uses designated for Cowdrey Drainage and South Boulder Creek.

A larger issue relates to the PRP's proposal in August 2001 to discontinue groundwater collection and treatment so that they can evaluate the effects on groundwater flow, groundwater quality and surface water quality that result when those systems are no longer in use. The EPA can evaluate this proposal once the PRPs describe the monitoring approach that they intend to use to demonstrate the continuing protectiveness of the remedy following discontinuation of groundwater collection and treatment.

The remedy as designed, constructed and operated is protective of human health and the environment. The offsite migration of contaminated groundwater has been controlled by the successful operation of the groundwater collection and treatment system. Effluent from the water treatment system also consistently achieves the remediation standards.

FIVE-YEAR REVIEW SUMMARY FORM

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name *(from WasteLAN):* Marshall Landfill Site		
EPA ID *(from WasteLAN):* COD 980499255		
Region: VIII	**State:** CO	**City/County:** Boulder County

SITE STATUS

NPL status: ☒ Final ☐ Deleted ☐ Other (specify) _____

Remediation status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete

Multiple OUs? * ☐ YES ☒ NO **Construction completion date:** 05/93

Has site been put into reuse? ☐ YES ☒ NO

REVIEW STATUS

Lead agency: ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____

Author name: Rebecca Thomas

Author title: Project Manager **Author affiliation:** U.S. EPA

Review period: **: 07/10/01 to 09/20/01

Date(s) of site inspection: 07/26/01

Type of review:
☒ Statutory ___/___/_____
☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead
☐ Regional Discretion

Review number: ☐ 1 (first) ☒ 2 (second) ☐ 3 (third) ☐ Other (specifiy) _____

Triggering action:
☐ Actual RA Onsite Construction at OU #_____ ☐ Actual RA Start at OU # _____
☐ Construction Completion ☒ Previous Five-Year Review Report
☐ Other (specify)

_____

Triggering action date (*from WasteLAN*): 11/13/1995

Due date (*five years after triggering action date*): 09/30/2001

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form (continued)

Issues:

Item No.	Issue	Affects Current Protectiveness of Remedy	Affects Future Protectiveness of Remedy
1	Soil cover missing where landfill debris exposed.	No	Potentially
2	Sparse vegetation in limited areas with steeper slopes.	No	Potentially
3	Limited signage posted to discourage trespassing.	No	Potentially
4	Failure to report results for 1,2-DCA in Offsite Water Quality Monitoring Report.	No	No
5	Detection limits reported for some VOCs in the Offsite Water Quality Monitoring Report are higher than relevant water quality standards and remediation standards.	No	No
6	Protectiveness of remediation standards for designated uses of Cowdrey Drainage and South Boulder Creek has not been demonstrated.	No	See Recommendation
7	Groundwater influent to treatment system meets effluent remediation standards; PRPs propose to discontinue groundwater collection and treatment.	No	See Recommendation

Recommendations and Follow-up Actions:

Item No.	Issue	Recommendation for Follow Up	Party Responsible
1	Soil cover maintenance	Continue active efforts to maintain and improve landfill vegetative cover.	PRPs
2	Vegetative cover maintenance	Continue active efforts to maintain and improve landfill vegetative cover.	PRPs
3	Limited signage to discourage trespassing on landfill cover	Post additional signs around landfill. Continue to monitor public access to the Site.	PRPs
4	Failure to report results for some monitored constituents	Review monitoring plans and correct future requests for water analyses to include all planned water-quality tests.	PRPs
5	Detection limits reported for some monitored constituents in recent Offsite Water Quality Monitoring Reports are higher than relevant standards	Review remediation standards and relevant water quality standards and implement sample analysis plan that provides quantitative data for comparison to the numeric standards.	PRPs
6	Protectiveness of remediation standards in question.	Perform additional surface water sampling and analysis to demonstrate that beneficial uses for Lower Cowdrey Drainage and South Boulder Creek are protected; propose point of compliance for monitoring offsite surface water quality.	PRPs
7	Treatment of collected groundwater appears un-necessary to achieve remediation standards for the contaminants identified in the Consent Decree, except for iron and manganese	1. Develop long-term monitoring approach that provides the data needed to track changes in water quality and demonstrate ongoing protectiveness of the remedy after treatment discontinued; propose point of compliance for monitoring offsite groundwater quality. Submit to EPA for review and approval.	PRPs
		2. Evaluate PRPs proposal to discontinue groundwater collection and treatment systems, in accordance with Consent Decree requirements.	EPA

Protectiveness Statement(s):

The remedy as designed, constructed and operated is protective of human health and the environment. The offsite migration of contaminated groundwater has been controlled by the successful operation of the groundwater collection and treatment system. Effluent from the water treatment system also consistently achieves the remediation standards.

Other Comments:

The PRPs have proposed discontinuing operation of the groundwater collection and treatment components of the remedy, but they have not demonstrated at this time that the proposed change will not adversely affect the future protectiveness of the remedy. Additional monitoring activities will be necessary to demonstrate that the remedy will remain protective following discontinuation of groundwater collection and treatment, as noted in the recommendations.

Marshall Landfill Site
Boulder County, Colorado
Second Five-Year Review Report

I. Introduction

The U.S. Environmental Protection Agency (EPA) Region VIII has conducted a second five-year review of the remedial actions implemented at the Marshall Landfill Site (the Site) in Boulder County, Colorado. The Site consists of two parcels, the original 80-acre Marshall Landfill and the newer 80-acre Boulder Landfill. Both landfill operations are inactive. Remedial actions taken primarily to address conditions at the older Marshall Landfill are the focus of this five-year review.

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of the review are documented in the five-year review report. In addition, the five-year review report identifies deficiencies found during the review, if any, and identifies recommendations to address them. This second five-year review was conducted from July 2001 through September 2001. MFG, Inc., an EPA contractor, supported EPA in the preparation of this review.

This review is required by statute. The EPA must implement five-year reviews consistent with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA 121(c), as amended, states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.*

The NCP, Part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR), states:

> *If a remedial action is selected that results in hazardous substances, pollutants or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This is the second five-year review of the Marshall Landfill Site. The trigger action for this review is the completion of the first five-year review on November 15, 1995. Due to the fact that hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unrestricted use and unlimited exposure, another five-year review is required.

II. Site Chronology

Table 1. Chronology of Site Events

Date	Event
1965	Solid waste management operations begin at the Site under management of Richland Company
1969	Operations purchased by Salvage, Inc., later renamed Urban Waste Resources (UWR)
1970-1974	UWR operated solid waste landfill
1974	UWR abandoned Marshall Landfill and, with Mesa Sand and Gravel, opened the Boulder Landfill to the south
1975	Landfill, Inc., a wholly owned subsidiary of Browning-Ferris Industries (BFI), purchased the operation.
July 1982	EPA proposes Marshall Landfill for NPL.
September 1983	Marshall Landfill included on NPL.
1983	EPA, Landfill, Inc., Boulder County, Colorado Department of Health, City of Louisville and Farmers Reservoir and Irrigation Co. enter into a Cooperative Agreement.
1983	EPA issued order to Landfill, Inc. requiring them to install Community Ditch pipeline by 1984.
1985	RI/FS completed by Landfill, Inc.
September 1986	ROD issued by EPA.
March 1989	Consent Decree finalized and accepted by all parties (EPA, City of Boulder, Landfill, Inc. and landowners).
1989-1990	Additional site investigations performed.
1992	Boulder Landfill closes.
May 1992	Final Design Submittal approved by EPA.
November 1992	Explanation of Significant Differences to ROD issued by EPA.
1993	Remedial action construction considered complete with EPA approval of Final Remedial Measures Implementation Report.
1993	Final O&M Plan approved by EPA.
November 1995	First five-year review completed.
1996	Corrective measures completed to address seepage identified in first five-year review.
1997	Final Revised Offsite Water Quality Monitoring Plan approved by EPA.

III. Background

Location and Setting

The Marshall Landfill Site is located in southeastern Boulder County, approximately one mile east of the town of Marshall. The Site is south of Colorado Highway 170 and is bounded on the east by South 66th Street. Marshall Lake is located approximately 2,000 feet to the west. Approximately two miles east is the town of Superior (population of 9,000). The cities of Boulder (population 94,700) and Louisville (population 19,000) are three miles to the northwest and northeast, respectively. The area within a one-mile radius of the Site is sparsely populated.

The land surrounding Marshall Landfill is used primarily for livestock grazing. The other adjacent land uses are as follows: (1) storage facility for the National Center for Atmospheric Research on the east side of South 66th St.; (2) an irrigation and municipal drinking water reservoir, Marshall Lake, immediately to the west of the Site; and (3) small, non-food warehouse building to the northeast of the Site that has been previously leased for a variety of storage uses.

The Site lies along the north-facing side of Lake Mesa and within the Cowdrey Drainage, which conveys surface water from Cowdrey Reservoir No. 2 approximately 3 miles to South Boulder Creek (see map in Attachment 1). At some times in the past, Cowdrey Drainage flow was diverted to Davidson Ditch where it was used for irrigation. Community Ditch also flows along this drainage, and at various times of the year it carries water from South Boulder Creek to Marshall Lake. Drainage from Marshall Lake flows east to the City of Louisville, where it is used as drinking water and then farther east, where the flow is used as irrigation water. Additionally, two small lagoons, dug by Boulder County in an attempt to collect and contain landfill leachate, were previously located within the Marshall Landfill Site.

Lake Mesa is a broad, upland pediment surface, consisting of a gravel-capped bedrock erosional surface along the crest, a series of colluvial and terrace deposits along the flanks, and colluvial and weathered soil along Cowdrey Drainage. Refuse in the Marshall Landfill was placed along the bedrock slope north of Cowdrey Drainage, down into Cowdrey Drainage and up along the flank of Lake Mesa.

The uppermost hydrostratigraphic unit is an unconfined aquifer consisting of: (1) alluvial sands, gravels and clays mantling the top and flank of Lake Mesa; (2) colluvial material along the base of Lake Mesa; (3) weathered bedrock and alluvium along Cowdrey Drainage; and (4) refuse placed in the Marshall Landfill. Underlying the Site, groundwater flow in the shallow alluvial aquifer is generally to the north and northwest and along Cowdrey Drainage.

Deeper hydrostratigraphic units are bedrock aquifers within the Laramie and Fox Hills Formations. These units underlie the shallow alluvial and colluvial deposits that make up the shallow aquifer. The regional groundwater flow direction in the bedrock aquifers is to the east.

Site History

The Site consists of two adjacent landfills, each comprising approximately 80 acres. The Marshall Landfill, located to the north, began operating in 1965, when the Richland Company, under contract with Boulder County, began a solid waste composting and disposal operation at the Site. Although the contract specified composting operations, landfilling comprised the

majority (80%) of waste handling activities. In 1969, the operation was sold to Salvage, Inc., which was later acquired by a group of local investors and renamed Urban Waste Resources (refer to Table 1). Between 1969 and 1974, the Marshall Landfill accepted municipal waste, unstabilized sewage sludge and many unknown, potentially hazardous wastes. In 1974, the Marshall Landfill was abandoned when Urban Waste Resources, along with Mesa Sand and Gravel, opened the Boulder Landfill to the immediate south. Landfill, Inc., a wholly owned subsidiary of Browning-Ferris Industries (BFI), purchased the landfill operation in 1975. The Boulder Landfill closed in January 1992. BFI is now owned by Allied Waste Industries. Throughout the period of landfill operations, the land has been owned by The Cowdrey Corporation.

In September 1983, the Marshall/Boulder Landfill was listed on the National Priorities List (NPL) due to the release of contamination to irrigation and drinking water. A major concern was the contamination of water flowing in Community Ditch because it serves as a source of drinking water for the City of Louisville. In response to this concern, a 60-inch pressurized pipeline was installed to convey the water across the inactive landfill.

Several sources of contamination were identified during the Remedial Investigation/Feasibility Study (RI/FS), which was conducted in 1986. These include:

- Areas of saturated refuse within the northern portion of the Boulder Landfill and throughout the Marshall Landfill;
- Trenches used for waste disposal between 1972 and 1974 at the Marshall Landfill;
- Small, undefined areas within the Marshall Landfill where industrial wastes, primarily organic solvents, were disposed along with solid wastes; and
- Two unlined leachate lagoons in the southern portion of the Marshall Landfill.

No contamination was detected in surface waters leaving the Site via Cowdrey Drainage and Community Ditch during the RI. However, after completion of the RI, 1,1-dichlorethane was detected at 5 μg/L in surface water from the Cowdrey Drainage. Onsite groundwater within the shallow alluvial aquifer was found to be contaminated, as characterized by elevated levels of:

- Volatile organic compounds (VOCs) such as benzene, trichloroethene (TCE) and tetrachloroethene (PCE);
- Heavy metals such as barium, iron, manganese and zinc; and
- Major ions, such as chloride, nitrate and sulfate.

No contamination was identified in the deeper bedrock aquifer.

Based on the findings of the RI/FS, EPA selected a preferred remedy, which was described in their 1986 Record of Decision (ROD).

IV. Remedial Actions

The following remedial action objectives for the Marshall Landfill Site were included in the Feasibility Study and ROD:

- Assure that all surface water discharge from the landfills does not adversely impact the current or planned future beneficial uses of the surface waters in this area or any other waters that it may contact;
- Control the generation of contaminated groundwater at the Site;
- Assure that any offsite contaminated groundwater originating at the Site does not adversely impact the possible beneficial uses of the groundwaters in this area or any other surface waters and groundwaters it may contact;
- Eliminate or control the impacts resulting from leachate seepage in the landfills.

Remedy Selection

The remedy described by the ROD involves: collection of contaminated groundwater leaving the Site; treatment of the collected groundwater; environmental monitoring; and landfill improvements. The ROD remedy also includes offsite monitoring to determine the existence and detrimental effect of offsite sources of contamination to the area.

The major components of the remedy selected by the ROD include:

- Elimination of offsite transport of contaminants emanating from the Site by constructing a drain or series of drains to capture shallow groundwater along the entire southern and eastern site boundaries;
- Treatment of contaminated groundwater in a facility consisting of equalization/sedimentation basins, an air stripper, and carbon adsorption of air stripper off gas (vapor-phase granular activated carbon, or VGAC);
- Implementation of an environmental monitoring program to verify the effectiveness of the remedial action and to assure protection of public health;
- Completion of landfill improvements, including regrading, revegetation, perimeter ditches and fences to minimize future environmental and public health impacts from the Site;
- Drainage of existing leachate lagoons and transfer of the liquid to the treatment system; and
- Redirection of the discharge of the existing french drain (installed to collect seepage during landfill operations) to the treatment facility.

A Consent Decree was entered into on March 29, 1989. Its parties are EPA and the primary responsible parties (PRPs) – Landfill, Inc. (now BFI), City of Boulder and certain landowners. Section IV of the Consent Decree requires the PRPs to design, construct, operate, maintain and monitor the performance of the remedial measures implemented at the Site. Exhibit II (Scope of Work to the Consent Decree) details the procedures, tasks and schedule to be followed by the PRPs in performing the selected remedial action. The remedial action required by the Consent Decree is the same as that described by the ROD and consists of the following tasks: Task I-Landfill Improvement; Task II-Groundwater Collection and Treatment; Task III-Monitoring. The Consent Decree also established the methods by which remediation standards for water quality would be developed for the Site.

Additional investigations were carried out in 1989 and 1990 in order to provide information needed to design the collection and treatment systems specified in the ROD and determine the remediation standards. In 1992, based on the findings of these investigations, EPA issued an

Explanation of Significant Differences (ESD) to the 1986 ROD Remedy. The ESD included four significant modifications to the remedy as originally selected:

- The groundwater collection system was changed to consist of a well array along most of the eastern site boundary and a collection trench along part of the southern and eastern site boundaries instead of the series of drains specified by the ROD;
- Breakpoint chlorination/dechlorination was added to the treatment system to remove ammonia from collected groundwater prior to its discharge;
- In addition to the air stripper and air stripper off-gas carbon adsorption system specified in the ROD, a liquid-phase carbon adsorption system (liquid-phase granular activated carbon, or LGAC) was added to remove VOCs; and
- The effluent limitation for chloride was changed from 280 mg/L to 320 mg/L, after the Colorado Water Quality Control Commission modified the numeric water quality stream standard for chloride to 320 mg/L.

Remedy Implementation

The remedy implemented is the remedial action selected in the 1986 ROD, as subsequently modified in the 1992 ESD. The approved Final Remedial Measures Implementation Report (Harding Lawson, 1993) included the following components:

1. Groundwater Collection System

This system was designed and constructed with the objective of eliminating the eastward and southward migration of contaminated groundwater in the shallow groundwater system from the Site and collection of water from the seepage face and existing french drain. This collection system consists of: a combination of a collection trench and an extraction well array, situated along the southern and eastern boundaries of the Site; a subdrain to collect seepage drainage; and a pipe to convey water from the existing french drain to the treatment plant. A series of sumps withdraw water from the collection trench and pump it to the water treatment plant. The well array consists of a linear series of wells that extend to the base of the shallow groundwater system.

Installation and construction of the groundwater collection system components described above were complete in May 1993.

2. Water Treatment Facility

The water treatment facility was constructed for the treatment of contaminated groundwater collected at the Site and was designed so that the effluent meets performance standards described in the ROD and Consent Decree. Originally the facility treated contaminated groundwater from the collection trench, the extraction well array and the existing french drain; the system now also treats water collected from the more recently installed seepage-face subdrain. The nominal steady-state design flow rate for this treatment plant is 90 gallons per minute.

The treatment system was designed and constructed to treat for phenols, metals, VOCs and ammonia. Treatment of contaminated groundwater consists of air stripping, equalization/

sedimentation, liquid-phase carbon adsorption, breakpoint chlorination for ammonia removal and dechlorination. A VGAC process is used for treatment of air stripper off gas. Sludge generated in the treatment process is settled and dewatered with a sludge filter press. The design strategy for this treatment facility was to minimize the potential of future operational problems causing process upset or bypass and to meet or exceed wastewater discharge applicable or relevant and appropriate requirements (ARARs).

The treatment facility construction was completed on May 12, 1993, at which time the water treatment system was considered operational and functional.

3. Landfill Improvements

The objectives of the landfill improvements for the inactive Marshall Landfill were to: (1) ensure adequate fencing and posting of both landfills to restrict public access; (2) drain the two lagoons on the Marshall Landfill and treat recovered liquids at the treatment facility; (3) redirect the french drain discharge to the treatment facility; and (4) regrade the landfills, install perimeter surface drainage ditches and revegetate the landfill with native grass to minimize infiltration of precipitation and stabilize the soil cover.

The landfill regrading activities were completed on November 17, 1989. A total of 96,000 cubic yards of loose fill material was placed on the Marshall Landfill. A final inspection of the Marshall Landfill regrading and revegetation project was conducted on December 2, 1989 by the EPA. All remaining landfill improvements, including soil cover and revegetation, were considered complete on August 9, 1993.

4. Monitoring

A system of monitoring wells was included in the remedial action construction plans. The objective of these monitoring wells is to permit collection of groundwater samples and measurement of water levels representative of the shallow groundwater system. The drilling and completion of both monitoring and extraction wells was initiated in the spring of 1992 and completed in May 1993.

Remedy Operation and Maintenance

The PRPs are conducting long-term monitoring and maintenance activities in accordance with the Operations and Maintenance Plan (O&M Plan) (OMI, 1993), and Final Environmental/ Performance Monitoring Plan (HLA, 1990).

The primary activities associated with O&M of the groundwater treatment facility include:

- water treatment system facility operation and maintenance;
- routine treatment system process monitoring;
- groundwater collection system operation and maintenance; and
- maintenance of landfill improvements.

Operations and maintenance activities are performed on behalf of the PRPs by Operations Management, Inc. (OMI). OMI prepares O&M progress reports that are submitted to EPA semi-annually.

The major elements of the environmental/performance monitoring program are:

- piezometric monitoring in the vicinity of the groundwater collection system;
- monitoring of the collection system inflow;
- offsite surface water and groundwater monitoring; and
- monitoring of the water treatment system effluent.

In accordance with the Final Environmental/Performance Monitoring Plan, piezometric monitoring and influent water quality monitoring are performed semi-annually. Offsite surface water and groundwater quality monitoring are performed annually. The water treatment plant effluent monitoring includes monthly sampling and analysis of water from the treatment system outfall, routine sampling and analysis of sludge generated by the treatment system for waste characterization, and quarterly biomonitoring to establish the toxicity of effluent water for aquatic life.

Monitoring results are reported to EPA according to the reporting requirements and schedules in the Final Environmental/Performance Monitoring Plan and subsequent sampling and analysis plans (Final Piezometric Monitoring Plan, Revised Offsite Water Quality Monitoring Plan, Final Treatment System Inflow Monitoring Plan, Final Effluent Monitoring Plan).

Since the last five-year review in 1995, the annual costs associated with operation and maintenance of the water treatment plant, including monthly effluent monitoring, have ranged from $493,000 to $539,000. The original estimate of routine annual O&M costs included in the 1986 ROD was approximately $70,000. On average, the various other water-quality monitoring programs implemented at the Site have a total annual cost of approximately $120,000. These costs are slightly higher than the original cost estimate of $90,000 per year included in the ROD.

V. Progress Since First Five-Year Review

The concerns identified in the first five-year review were all related to maintenance of landfill improvements, as follows:

- wind erosion damage,
- landfill revegetation issues,
- development of runoff swales and
- seepage from landfill.

Seepage observed in the southern portion of the Marshall Landfill area, in the vicinity of former Lagoon No. 1, was reduced through a corrective measure that was completed in 1996. The PRPs prepared a Work Plan for Seep Remediation (HLA, 1995), which included a gravel-trench subdrain for seepage collection, that was reviewed and approved by EPA in 1995. The seep-remediation measures described by that plan were completed in 1996.

The remaining concerns identified by the first five-year review are being addressed through ongoing maintenance of the landfill's soil cover and vegetation.

Table 2. Actions Taken Since the Last Five-Year Review

Deficiency	Party Responsible	Action Taken	Date of Action
wind-erosion damage	PRPs	continued maintenance of native grass cover	ongoing
landfill revegetation	PRPs	continued maintenance of native grass cover	ongoing
runoff swales	PRPs	rip rap placed in runoff swale on west side of landfill to stabilize soil	1996
seepage in vicinity of former Lagoon No. 1	PRPs	gravel trench subdrain installed to collect seepage and route water to treatment plant	1996

VI. Five-Year Review Process

This is the second five-year review of the Marshall Landfill Site.

Administrative Components

The Marshall Landfill five-year review team was lead by Rebecca Thomas, the EPA project manager, and included technical staff from EPA's contractor, MFG, Inc., with expertise in the areas of geology, geochemistry, hydrogeology and chemical engineering. Jennifer Chergo of EPA acted as the Community Involvement Coordinator for the five-year review.

The review was initiated in July 2001 and included the following components:

- Community Involvement,
- Local Interviews,
- Document Review,
- Data Review,
- Site Inspection and
- Five-Year Review Report Development and Review

The schedule for the review extended through September 2001.

Community Involvement

Activities to involve the community in this second five-year review were initiated July 26, 2001, in a meeting among the EPA review team, a representative from the Colorado Department of Public Health and Environment (CDPHE) and representatives from the City of Boulder and Allied Waste Industries. During the weeks of August 27 and September 3, a notice was placed in three local newspapers to explain that a five-year review was being conducted. The notice invited members of the public to submit their questions or comments regarding the review to EPA.

Interviews were conducted with various parties connected to the Site. The interviews were completed in August. Individuals from the nearby communities of Superior and Louisville and staff from relevant Boulder County government agencies and CDPHE were interviewed by MFG, Inc. with assistance from the EPA Community Involvement Coordinator. The current landowner, Cowdery Corporation, was also interviewed in August. The following individuals were interviewed:

1. Dave Kitchel, Operations Management, Inc., Marshall Water Treatment Plant Manager, interviewed 7/31/01;
2. Fonda Apostolopolous, CDPHE, interviewed 8/23/01;
3. Tom Fair, City of Louisville, Director of Public Works Department, interviewed 8/23/01;
4. Bruce Williams, Town of Superior, Town Manager, interviewed 8/23/01;
5. Jeff Zayech, Boulder County, Health Department, interviewed 8/23/01;
6. Peter Fogg, Boulder County, Land Use Department, interviewed 8/23/01; and
7. James Cohig, representing current landowner (The Cowdery Corporation), interviewed 8/27/01

In October 2001, a notice will be placed in the same three local newspapers announcing that the five-year review has been completed and that copies of the report are available for the public to review at the EPA Superfund Records Center in Denver, CO and Boulder Public Library in Boulder, CO.

Document Review

In preparing this five-year review report, the following documents were reviewed:

- EPA Record of Decision, 1986
- Consent Decree, 1989
- Final Design Submittal, 1991
- Final Environmental/Performance Monitoring Plan, 1990
- Final Collection System Inflow Monitoring Plan, 1991
- Explanation of Significant Difference, 1992
- Non-significant change to Record of Decision, 1993
- Preliminary Site Close-out Report, 1993
- Final Remedial Measures Implementation Report, 1993
- Final O&M Plan, 1993
- Work Plan for Seep Remediation, 1995
- Revised Offsite Water Quality Monitoring Plan, 1997
- O&M Plan Revision, 1998
- Operations and Maintenance Progress Report Nos. 14 and 15, 2001
- Technical Memorandum: Proposal to Terminate Active Remediation System Operation with Long-Term Groundwater Monitoring, 2001

Full reference citations are included in Attachment 2 for each of the documents reviewed.

Applicable surface water quality standards and drinking water regulations were also reviewed to identify any changes since development of the remedy (ROD and ESD) and EPA's approval of the Final Design Submittal (1991).

Data Review

The remedy includes a multi-component monitoring program designed to track groundwater levels and to evaluate groundwater and surface water quality, as well as the quality of water entering and leaving the water treatment system. Each monitoring component has specific objectives for demonstrating the performance of the remedy.

In preparing this five-year review report, data from the following monitoring reports were reviewed and evaluated:

- Sludge Disposal Letter, October 2000
- Collection System Inflow Monitoring Results for December 2000
- Piezometric and Offsite Water Quality Monitoring Results for December 2000
- Quarterly Biomonitoring Results for March and June 2001
- Collection System Inflow Monitoring Report for June 2001
- Effluent Monitoring Results for May, June and July 2001

A summary of these data and their interpretation for demonstrating remedy performance for each of the monitoring components is provided below.

Groundwater Collection System and Treatment System Inflow Monitoring

The purpose of this monitoring component is to generate water-quality data on which to base a decision to discontinue treatment facility operation, in accordance with the conditions outlined in the Consent Decree. The treatment system inflow monitoring includes monitoring inflows from the groundwater collection system, the former French drain system and seepage control subdrain. Monitoring is also performed at a central collection point prior to inflow to the water treatment system. These data are collected and reported semi-annually.

Over the past four years, the flow rate from the groundwater collection system into the treatment system generally has been in the range of 20 to 30 gallons per minute (gpm). The 2001 Technical Memorandum submitted by the PRPs (Arcadis G&M, 2001) indicates that the concentrations of all of the groundwater contaminants identified in the ROD and Consent Decree, with the exception of total dissolved solids (TDS), iron and manganese, have been below the Colorado Groundwater Quality Standards (i.e., Colorado Basic Standards for Groundwater) in the combined influent groundwater. TDS, iron and manganese concentrations were below their background concentrations, as measured immediately upgradient of the Site. For the metals listed as contaminants in the Consent Decree, all except iron and manganese have been below the Colorado Groundwater Quality Standards since June 1994.

Since 1994, concentrations of VOCs have been declining in groundwater. TCE and PCE have not been measured above the Colorado Groundwater Quality Standards (0.005 mg/L for both VOCs), or the effluent remediation standard (also 0.005 mg/L for both VOCs), in influent groundwater since December 1998. Benzene has not been detected in the influent groundwater above either the Colorado Groundwater Quality Standard or effluent limitation since 1995. The PRPs estimate that for the five years from 1995 through 1999 the treatment system removed fewer than 5 pounds of VOCs from groundwater; fewer than 40 pounds of VOCs have been removed since the system started operation in 1993 (Arcadis G&M, 2001).

Piezometric and Offsite Water Quality Monitoring

The purpose of the piezometric monitoring is to provide data that can be used to evaluate the effectiveness of the groundwater collection system in preventing groundwater flow from the landfilled materials and shallow groundwater system underlying the Site past the collection system. Specific performance standards were adopted for demonstrating that the collection system represents a "no-flow" boundary.

The most-recent piezometric monitoring data indicate that the groundwater collection system meets its performance standards and is effectively capturing groundwater from the Site. For example, the groundwater piezometric surfaces shown in monitoring reports from 2000 and 2001 illustrate that groundwater on the eastern and southern portions of the Site is captured by the recovery system.

The purpose of the offsite water quality monitoring component is to monitor the effectiveness of the remedy in ensuring that surface water and groundwater quality beyond the Site boundaries are at levels considered protective of human health and environment, as defined in the Consent Decree. Since 1997, surface water quality has been monitored at one location along Community Ditch and at two locations along Cowdrey Drainage between Community Ditch and Highway 170 (Marshall Road), and offsite groundwater quality has been monitored at 15 locations in the shallow aquifer and at 7 locations in the deeper bedrock aquifer. The shallow aquifer monitoring network includes three background locations upgradient of the Site. Offsite groundwater monitoring was performed semi-annually through 1996 and annually thereafter.

The October 2000 offsite water quality monitoring report indicates that the concentrations of PCE and TCE exceeded their drinking water standards in groundwater collected east of the Marshall Landfill Site. No data were reported for 1,2-dichloroethane (1,2-DCA) in offsite groundwater. The remaining VOCs were either not detected or were present at concentrations below their drinking water standards. However, the detection limits reported for some VOCs (PCE, TCE, 1,1-dichloroethene [1,1-DCE] and benzene reported at detection limit of 0.01 mg/L) were higher than the corresponding drinking water standard.

For the inorganic parameters, iron and manganese were present in offsite groundwater at concentrations above drinking water standards, but their concentrations were less than the background concentrations measured in upgradient wells at the Site. Nitrate was also present at concentrations above the drinking water standard in shallow groundwater at locations both upgradient and downgradient of the Site.

The October 2000 surface water monitoring results indicate exceedances of water quality standards in Cowdrey Drainage (at South 66th St.) for iron, lead, zinc and ammonia. No VOCs were detected in either Cowdrey Drainage or Community Ditch water. However, the detection limits reported for some VOCs (PCE, TCE, 1,1-DCE, benzene) were higher than the corresponding surface water standard so that maintenance of the water quality standards in Cowdrey Drainage could not be confirmed for those VOCs. No results were reported for 1,2-DCA and trans-1,2-DCE in surface water in 2000.

Treatment System Effluent Monitoring

The purpose of the treatment system effluent monitoring is to demonstrate that the water discharged by the water treatment plant meets the remediation standards established by the

Consent Decree (presented in the Final Design Submittal, 1991). The effluent water is sampled at the surface outfall from the treatment plant located adjacent to South 66th St.

The semi-annual O&M Progress Reports for the second half of 2000 and first half of 2001 and the monthly effluent monitoring reports from May, June and July 2001 were reviewed. Based on these reports, effluent discharged from the water treatment plant consistently meets the remediation standards established in the Consent Decree and Final Design Submittal

Site Inspection

Site inspections were performed on July 26 and July 31, 2001 by the EPA remedial project manager and the MFG project manager. The site inspection objectives were to observe the operations of the water treatment system and to evaluate the maintenance of the groundwater collection system and landfill improvements. The following records were provided by Dave Kitchel, the water treatment plant manager, for review during the site inspection: O&M Plan, O&M reports and maintenance logs for water treatment system; Site-Specific Health and Safety Plan; operator training records; and monitoring records. A site inspection checklist was completed to document the items evaluated by the review team.

There were no problems noted in operation and maintenance of the groundwater collection and treatment system. Computer database software is used to schedule routine preventative maintenance. This system is also used to track and record the maintenance activities as they are performed. The plant manager reported that the breakpoint chlorination/dechlorination system for removal of ammonia is not routinely operated due to low ammonia content of inflow water and that two of the original groundwater extraction wells were no longer operating. Piezometric monitoring has demonstrated that loss of these two extraction points has not reduced the overall effectiveness of the groundwater collection system.

Previous concerns regarding the condition of landfill improvements appear to have been addressed. The vegetative cover is in good condition. Recent O&M Progress Reports indicate that a herd of goats has been used at various times over the last year to control weeds, provide fertilizer and thereby improve the condition (i.e., health and density) of the native-grass vegetation. At the time of the inspection, no seepage was observed in the vicinity of former Lagoon No. 1 and the corrective measures taken in that area appear to be effectively capturing water before it seeps at the surface. In some areas with steeper slopes, coarse fill materials, such as large metal items, were partially exposed at the ground surface indicating erosive loss of the soil cover. The original design calls for a 2-foot thick soil cover over the landfill refuse. Vegetation on these steeper slopes was sparse. An erosion rill was observed along the western boundary of Marshall Landfill, south of Cowdrey Reservoir No. 1. The water treatment plant manager reported that erosion controls had been implemented in 1996, including placement of rip rap to prevent further erosion, and that water has only been observed flowing within the rill during times of heavy rainfall runoff.

The Marshall Landfill is surrounded by a barbed-wire fence, but the Site can be easily accessed by trespassers. There are no signs posted indicating that the area is private property except on an access gate along South 66th St. directly across the road from the water treatment plant. Onsite staff reported that the Site is infrequently trespassed by recreational bicyclists. Impacts from such use are expected to be negligible. However, if recreational use of the area increases significantly in the future, increased vegetative stress and erosion of the landfill cover could eventually occur.

Interviews

MFG, Inc. contacted individuals from the surrounding communities of Superior and Louisville, officials with Boulder County government and the CDPHE, and landowners for interviews. A total of seven interviews were completed; other individuals contacted were unavailable in August.

There were no specific community concerns identified through the interview process. All individuals contacted expressed confidence that the remedy being implemented at the Marshall Landfill Site is effective in protecting human health and the environment.

Summary of Interview Highlights

Jeff Zayech of the Boulder County Health Department, Environmental Health Program, reported that the department received one phone call in the last five years from a local citizen with a question about the Marshall Landfill Site. The Boulder County Health Department feels confident that they can respond to such questions by informing citizens that the remedy is ongoing and ensures that groundwater and surface water quality are maintained. The County Health Department would have a concern regarding future activities at the Site if land use were to change to allow residential or other development that could disturb landfill materials.

Tom Fair at the City of Louisville Public Works Department also reported occasional calls from individuals with questions about potential impacts of the Superfund Site on drinking water quality. The City tells those individuals that the Site has not caused any water quality problems and that water quality is routinely monitored at the Site to confirm that drinking water contamination is not taking place. The City of Louisville receives some of their drinking water supply via Community Ditch, which is contained in a pressurized pipeline through the Site and in an open ditch immediately down stream of the Marshall Landfill. For the City of Louisville, future concerns are primarily related to any conditions that could potentially result in accelerated degradation of the pipeline over time.

Bruce Williams, the Superior Town Manager, had no specific concerns to report. He was not aware of any planned development in the area and said that land use was determined in part through an intergovernmental agreement among Boulder County, City of Boulder and Town of Superior. Although the Town of Superior obtains drinking water from another source, there are still some residents in the older portion of Superior who use well water. His only general concern was that these remaining groundwater users could see impacts to their water supply if there were release of contaminants to aquifers underlying the Marshall Landfill Site.

Peter Fogg of the Boulder County Land Use Department confirmed that residential or commercial uses would not be allowed at the Marshall Landfill property under existing zoning regulations. The land has “rural preservation status” that is to be maintained by Boulder County.

All of the interviewees requested copies of the second five-year review report, primarily for their departmental records should issues arise in the future.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, data, ARARs, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD, as modified by the ESD.

The site inspection demonstrated adequate compliance with all relevant plans, including the Site Specific Health and Safety Plan, Operations and Maintenance Plan and the various Environmental/Performance Monitoring Plans.

Landfill Improvements

Several years were required to establish sufficient vegetation to stabilize and reduce erosion of the soil cover by wind and runoff. Soil cover has eroded from several small areas on steeper slopes along Cowdrey Drainage, but there is no existing evidence that soil erosion from these areas reduces the overall effectiveness of landfill improvements.

One of the remedial action objectives of the ROD is to assure that surface drainage from the Site does not adversely impact beneficial uses of nearby surface waters. Surface water monitoring demonstrates that applicable water quality standards are generally maintained in Cowdrey Drainage and Community Ditch. The exceptions are minor exceedances of the chronic water quality criteria for iron, lead and zinc and the standard for ammonia in Cowdrey Drainage at low-flow conditions (October 2000).

Operation and maintenance of the landfill improvements, including the 1996 corrective measures, are generally effective in protecting surface water quality and in controlling generation of contaminated groundwater. Costs for maintaining the landfill improvements have been higher than expected. Since the last five-year review, those costs have included implementing seepage controls and performing active weed control.

Groundwater Collection and Treatment Systems

Operation of the groundwater collection system assures that contaminated groundwater originating at the Site does not adversely impact the possible beneficial uses of groundwater in this area or any other surface waters and groundwaters it may contact. The remediation standards for treated effluent have been consistently met since start up of the treatment system.

Two of the wells originally included in the collection system are no longer operational, but there has been no change in the effectiveness of the collection system as a result.

Offsite surface water and groundwater monitoring have demonstrated that applicable surface water quality standards are generally maintained in Cowdrey Drainage. Offsite groundwater continues to show concentrations of PCE and TCE above applicable groundwater quality standards.

Costs for groundwater collection and treatment average approximately $500,000 per year. These costs are substantially higher than anticipated during the remedy selection process. In addition, the mass of contaminants removed from groundwater is much less than anticipated during the design-phase of the remedial action. For this reason, the cost per pound of contaminant removal is much higher than anticipated.

An opportunity for optimization of the remedy was identified by the PRPs who proposed in August 2001 to discontinue groundwater collection and treatment. The basis for this proposal was a demonstration that the influent groundwater meets the remediation standards for all contaminants except for iron and manganese, which are present at concentrations below site-specific background. When the PRPs can demonstrate that the remedy will continue to be protective and meet the remedial action objectives after the treatment system is no longer in use, in accordance with the requirements set forth in the ROD and Consent Decree, this component of the remedy may be considered complete.

Monitoring Programs

The routine water quality monitoring programs in place are sufficient to demonstrate capture of contaminated groundwater by the collection system, detect changes in water quality in offsite surface water and groundwater and evaluate changes in groundwater quality over time.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

There have been no changes in the physical conditions of the Site or surrounding land uses that would change the exposure assumptions, cleanup levels or remedial action objectives for the Marshall Landfill Site.

Changes in ARARs

The remediation standards set forth in the 1989 Consent Decree and finalized in the 1991 Final Design Submittal and 1992 ESD were established by EPA to be protective of groundwater as well as surface waters in Cowdrey Drainage and South Boulder Creek. The remediation standards listed on Table 3 apply to effluent discharged from the water treatment plant. Since the remediation standards were adopted in 1991, there have been changes to applicable groundwater standards (Federal Safe Drinking Water Act and Colorado Basic Standards for Groundwater) and the standards for protection of designated uses for Cowdrey Drainage and South Boulder Creek (Colorado Basic Standards for Surface Water), in some cases to more stringent numeric standards. The applicable or relevant and appropriate water quality standards were reviewed, as summarized below.

Federal Drinking Water Standards and Colorado's Basic Standards for Groundwater apply to groundwater that migrates offsite. The remediation standards adopted for arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc, trans 1,2-dichloroethylene (trans 1,2-DCE), 1,1-DCE, ethylbenzene and toluene are more stringent than their current groundwater quality standards, which are also listed on Table 3.

Table 3. Site Remediation Standards and Groundwater Standards

Parameter	**Remediation Standard (mg/L) for 30-day average** (Final Design Submittal, Appendix A, Table 4)	**Federal Primary or Secondary Drinking Water Standard or Colorado Basic Standard for Groundwater[1]**
TDS	--	400 or 1.25 times background
Chloride	280	250
Sulfate	250	250
Ammonia	6	--
Nitrate (as N)	10	10
Nitrite (as N)	1.0	1.0
Arsenic	0.011	0.05
Barium	0.35	2
Cadmium	0.004	0.005
Chromium	0.05	0.1
Copper	0.05	1.0
Iron	0.3	0.3
Lead	0.038	0.05
Manganese	0.05	0.05
Mercury	0.002	0.002
Nickel	0.05	0.1
Selenium	0.01	0.05
Silver	0.001	0.1
Zinc	0.17	5.0
Phenols	0	0.3
1,2-dichloroethane	0.062	--
trans 1,2-dichloroethylene	0.070	0.100
1,1,1-trichloroethane	0.005	0.200
Tetrachloroethylene	0.005	0.005
1,1-dichlorothylene	0.005	0.007
Ethylbenzene	0.020	0.680
Toluene	0.025	1.0
Benzene	0.005	0.005
Trichloroethylene	0.005	0.005

[1]Current Federal Drinking Water Standards and Colorado Basic Standards for Groundwater were reviewed, and the most stringent standard is listed.

Table 4. Surface Water Quality Standards for Lower Cowdrey Drainage and South Boulder Creek Segment 4b

Parameter	Water Quality Standard[1] (mg/L) (acute/chronic if designated use is aquatic life)	Designated Use
Chloride	250	Water supply
Sulfate	250	Water supply
Ammonia	0.02	Aquatic life
Nitrate (as N)	10	Water supply
Nitrite (as N)	--	Water supply
Arsenic	0.05/0.05	Aquatic life
Barium	--	Aquatic life
Cadmium	0.0018/0.0013	Aquatic life
Chromium	0.016/0.011	Aquatic life
Copper	0.007/0.005	Aquatic life
Iron	0.3 (dissolved)	Water supply
Lead	0.03/0.0012	Aquatic life
Manganese	2.37/1.31	Aquatic life
Mercury	0.00001(total)	Aquatic life
Nickel	0.26/0.029	Aquatic life
Selenium	0.018/0.005	Aquatic life
Silver	0.0006/0.00002	Aquatic life
Zinc	0.065/0.066	Aquatic life
Phenols	4.20/2.56	Aquatic life
1,2-dichloroethane	0.38	Water supply
trans 1,2-dichloroethylene	0.100	Water supply
1,1,1-trichloroethane	0.200	Water supply
Tetrachloroethylene	0.005	Water supply
1,1-dichlorothylene	0.007	Water supply
Ethylbenzene	0.700	Water supply
Toluene	1.0	Water supply
Benzene	0.0012	Water supply
Trichloroethylene	0.0027	Water supply

[1]The most stringent standard among the various designated uses is listed. For hardness-dependent standards a hardness of 50 mg/L was assumed. For metals, standards are for total recoverable concentrations unless specified otherwise.

Surface water quality standards for the current use designations for Lower Cowdrey Drainage and South Boulder Creek Segment 4b are presented in Table 4 for comparison to the remediation standards for treated effluent water. The remediation standards do not generally match the most stringent water quality standards for these drainages. In some cases, the remediation standard is higher (i.e., less stringent) than the surface water quality standard (chloride, ammonia, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, benzene and TCE). In other cases, the remediation standard is lower (i.e., more stringent) than the surface water quality standard (arsenic, manganese, phenols, 1,2-DCA, trans 1,2-DCE, 1,1,1-trichloroethane [1,1,1-TCA], 1,1-DCE, ethylbenzene and toluene). Surface water from Cowdrey Drainage below the effluent discharge has concentrations of ammonia, iron, lead and zinc above the most stringent water quality standard.

Although some of the numeric standards provided by ARARs listed in the 1986 ROD are now more stringent, there is no evidence that those changes affect the protectiveness of the remedy.

Progress of Remedy

The remedy is progressing as expected. The remediation standards for treated effluent discharged from the water treatment plant are being consistently met.

In August 2001, the PRPs presented information to support their proposal to discontinue use of the groundwater collection and treatment systems. This information demonstrates that the influent groundwater meets the remediation standards, without treatment, for all contaminants other than iron and manganese, which are observed at concentrations below their site-specific background concentrations.

Surface water samples also indicate that applicable water quality standards are being met immediately downstream of the Site for all parameters except ammonia, iron, lead and zinc. Attainment of applicable water quality standards for PCE, TCE, 1,1-DCE, 1,2-DCA, trans 1,2-DCE and benzene could not be confirmed due to elevated detection limits or lack of data in recent monitoring reports.

VOC concentrations in groundwater have been decreasing with time, but the concentrations of PCE and TCE in shallow groundwater east of the Site continue to exceed their groundwater quality standards. Attainment of groundwater quality standards for PCE, TCE, 1,1-DCE, 1,2-DCA, trans 1,2-DCE and benzene could not be confirmed at all locations due to elevated detection limits or lack of data in recent monitoring reports.

Because some water quality standards are currently exceeded in Cowdrey Drainage downstream from the landfill and in the treated effluent discharge, further evaluation of the protectiveness of the remedy without the groundwater collection and treatment system is recommended.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Protection of surface water for all beneficial uses cannot be confirmed at this time because several parameters monitored in offsite surface water (PCE, TCE, 1,1-DCE, benzene) have surface water quality standards that are lower than their reported detection limits in recent monitoring reports. Concentrations of 1,2-DCA and trans 1,2-DCE were not reported for the most recent surface water samples from Cowdrey Drainage and Community Ditch.

Attainment of groundwater quality standards for PCE, TCE, 1,1-DCE, 1,2-DCA, trans 1,2-DCE and benzene could not be confirmed at this time due to elevated detection limits or lack of data in recent monitoring reports.

There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed, the site inspection and interviews, the remedy is operating and functioning as intended by the ROD, as modified by the ESD. There have been no changes to the physical conditions of the Site or surrounding land uses that would affect the protectiveness of the remedy. The remediation goals and objectives identified in the ROD and ESD and the

remediation standards included in the Consent Decree as performance criteria for the remedy are all consistently met. Those remediation standards are also consistently met for all parameters except iron and manganese in the combined influent groundwater collected for treatment. There is no other information that calls into question the protectiveness of the remedy.

VIII. Issues

Based on the information collected during the second five-year review report, the following issues were identified:

Table 5. Issues Identified

Item No.	Issue	Affects Current Protectiveness of Remedy	Affects Future Protectiveness of Remedy
1	Soil cover missing where landfill debris exposed.	No	Potentially
2	Sparse vegetation in limited areas with steeper slopes.	No	Potentially
3	Limited signage posted to discourage trespassing.	No	Potentially
4	Failure to report results for 1,2-DCA in Offsite Water Quality Monitoring Report.	No	No
5	Detection limits reported for some VOCs in the Offsite Water Quality Monitoring Report are higher than relevant water quality standards and remediation standards.	No	No
6	Protectiveness of remediation standards for designated uses of Cowdrey Drainage and South Boulder Creek has not been demonstrated.	No	See Recommendation
7	Groundwater influent to treatment system meets effluent remediation standards; PRPs propose to discontinue groundwater collection and treatment.	No	See Recommendation

IX. Recommendations and Follow-Up Actions

Table 6. Recommendations and Follow-Up Actions

Item No.	Issue	Recommendation for Follow Up	Party Responsible
1	Soil cover maintenance	Continue active efforts to maintain and improve landfill vegetative cover.	PRPs
2	Vegetative cover maintenance	Continue active efforts to maintain and improve landfill vegetative cover.	PRPs
3	Limited signage to discourage trespassing on landfill cover	Post additional signs around landfill. Continue to monitor public access to site.	PRPs
4	Failure to report results for some monitored constituents	Review monitoring plans and correct future requests for analyses to include all planned analyses.	PRPs
5	Detection limits reported for some monitored constituents in recent Offsite Water Quality Monitoring Reports are higher than relevant standards	Review remediation standards and relevant water quality standards and implement sample analysis plan that provides quantitative data for comparison to the numeric standards.	PRPs
6	Demonstrate protectiveness of remediation standards.	Perform additional surface water sampling and analysis to demonstrate that beneficial uses for Lower Cowdrey Drainage and South Boulder Creek are protected; propose point of compliance for monitoring offsite surface water quality.	PRPs
7	Treatment of collected groundwater appears un-necessary to achieve remediation standards for the contaminants identified in the Consent Decree, except for iron and manganese	1. Develop long-term monitoring approach that provides the data needed to track changes in water quality and demonstrate ongoing protectiveness of the remedy after treatment discontinued; propose point of compliance for monitoring offsite groundwater quality. Submit to EPA for review and approval.	PRPs
		2. Evaluate PRPs proposal to discontinue groundwater collection and treatment systems, in accordance with Consent Decree requirements.	EPA

Regarding Item No. 7 (Tables 5 and 6), the PRPs have recently submitted a proposal to temporarily discontinue operation of the groundwater collection and treatment systems so that they can monitor the effects of that change on groundwater flow, offsite groundwater quality and surface water quality. The proposal is aimed at allowing EPA to make a determination that the groundwater collection and treatment systems are not necessary to address any adverse water quality effects, in accordance with the provisions found on page 41 of the ROD. The proposal indicates that the collection and treatment systems would be maintained for potential future use (i.e., in stand-by mode) if monitoring data indicate that continued groundwater collection and treatment are necessary to maintain the performance of the remedy. The proposal is based on the

current site condition whereby groundwater that is collected and sent to the treatment system meets all of the remediation standards (except for the iron and manganese standards) without treatment.

EPA can evaluate and may approve this proposal after the PRPs prepare a monitoring plan that describes the methods that will be used to demonstrate the continued protectiveness of the remedy following discontinuation of groundwater collection and treatment. To address the recommendations of this five-year review, that monitoring plan should also include monitoring locations (i.e., compliance points) that will be used to monitor offsite surface water and groundwater quality in order to demonstrate that the remedial action objectives of the remedy are met and maintained.

X. Protectiveness Statement

The remedy as designed, constructed and operated is protective of human health and the environment. The offsite migration of contaminated groundwater has been controlled by the successful operation of the groundwater collection and treatment system. Effluent from the water treatment system also consistently achieves the remediation standards.

The PRPs have proposed discontinuing operation of the groundwater collection and treatment components of the remedy, but they have not demonstrated at this time that the proposed change will not adversely affect the future protectiveness of the remedy. Additional monitoring activities will be necessary to demonstrate that the remedy will remain protective following discontinuation of groundwater collection and treatment, as noted in the recommendations.

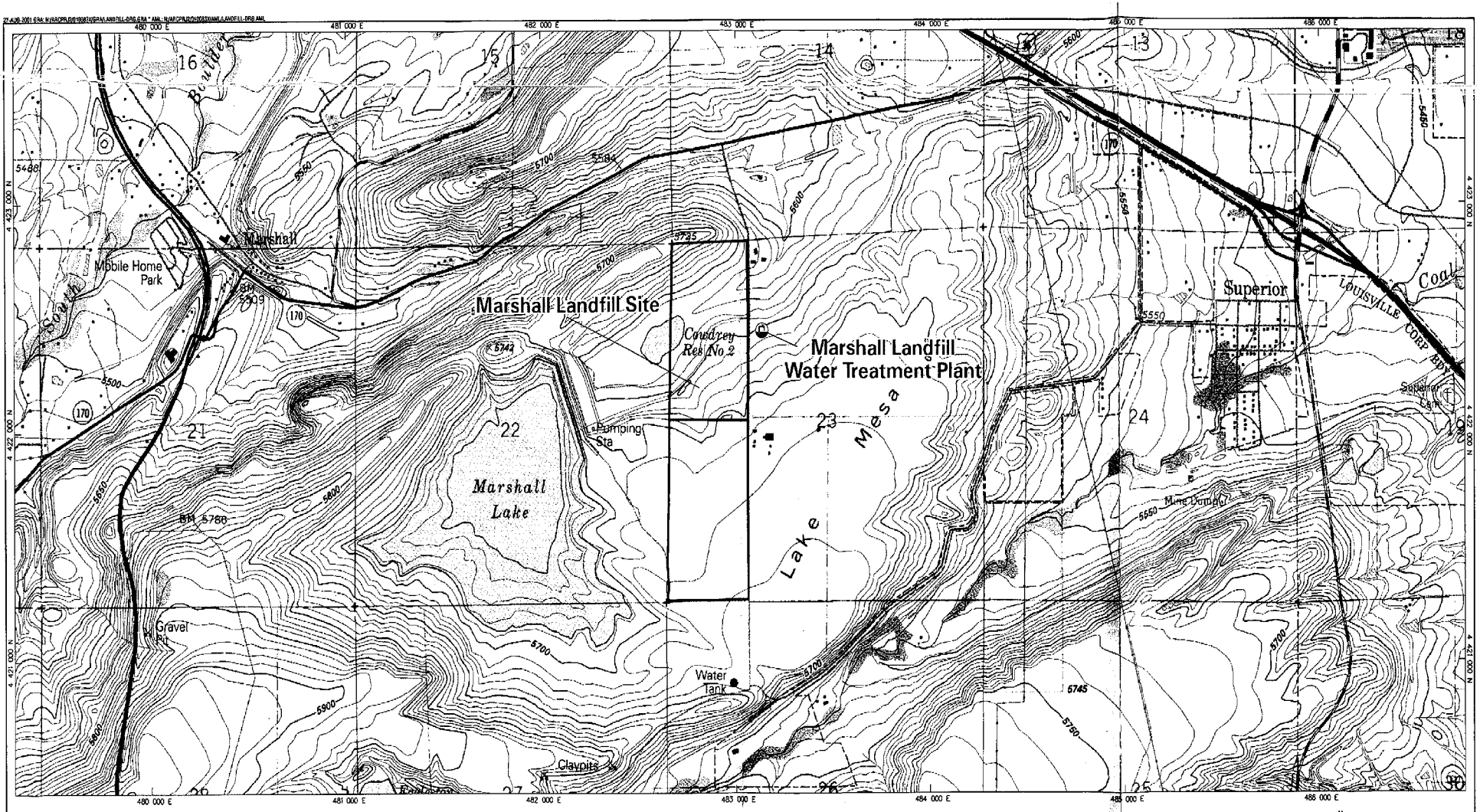
XI. Next Review

This Site requires ongoing five-year reviews in accordance with CERCLA §121(c). The next five-year review for the Marshall Landfill Site will be performed by September 2006, five years from the date of completion of this review.

ATTACHMENTS

ATTACHMENT 1

SITE MAP AND PHOTO



Site Features

Landfill Boundary

Water Treatment Plant

MARSHALL LANDFILL SITE
FIVE-YEAR REVIEW REPORT

Figure 1
Site Location Map

PROJECT: 01-0083x | DATE: AUGUST 27, 2001

MARSHALL LANDFILL SITE
FIVE-YEAR REVIEW REPORT

Figure 2 – Marshall landfil, Boulder, County, Colorado
(View looking northwest from water treatment plant across Marshall Landfill)

Project 01-0083x	Date: August 21, 2001

ATTACHMENT 2

DOCUMENTS REVIEWED

Documents Reviewed:

Arcadis G&M, 2001, Technical Memorandum: Proposal to Terminate Active Remediation System Operation with Long-Term Groundwater Monitoring, Prepared for Browning Ferris Industries and City of Boulder, August 23, 2001.

Harding Lawson Associates, 1990, Final Environmental/Performance Monitoring Plan, Marshall/Boulder Landfill Remediation Project, Boulder County, Colorado, Prepared for Browning Ferris Industries and City of Boulder, July 30.

Harding Lawson Associates, 1991a, Final Collection System Inflow Monitoring Plan, Marshall/Boulder Landfill Remediation Project, Boulder County, Colorado, Prepared for Browning Ferris Industries and City of Boulder, July 10.

Harding Lawson Associates, 1991b, Final Design Submittal, Marshall/Boulder Landfill Remediation Project, Boulder County, Colorado, prepared for Browning Ferris Industries and City of Boulder.

Harding Lawson Associates, 1993, Final Remedial Measures Implementation Report, Marshall/Boulder Landfill Remediation Project, Boulder County, Colorado, prepared for Browning Ferris Industries and City of Boulder, November 23.

Harding Lawson Associates, 1995, Work Plan for Seep Remediation, Marshall/Boulder Landfill Remediation Project, Boulder County, Colorado, prepared for Browning Ferris Industries and City of Boulder, July 3.

Harding Lawson Associates, 1997, Revised Offsite Water Quality Monitoring Plan, Marshall/Boulder Landfill Remediation Project, Boulder County, Colorado, prepared for Browning Ferris Industries and City of Boulder, May 7.

Harding Lawson Associates, 1998, Proposed O&M Plan Revision, Biennial Hazardous Waste Report Requirements, Marshall/Boulder Landfill Remediation Project, Boulder County, Colorado, letter to Ms. Paula Schmittdiel, U.S. EPA, from D.J. Braun, HLA, February 10.

Harding ESE, 2000, Piezometric and Offsite Water Quality Monitoring Event Results – October 2000, Marshall/Boulder Landfill Remediation Project, Boulder County, Colorado, prepared for Browning Ferris Industries and City of Boulder, December 6.

Operations Management Inc. (OMI), 1993, Final Operations and Maintenance Plan, Marshall/Boulder Landfill Remedial Systems.

Operations Management Inc., 2001a, Operations and Maintenance Progress Report for the Marshall/Boulder Landfill Remediation Project, June 1, 2000 through November 30, 2000, prepared for City of Boulder and Browning Ferris Industries, January 8, 2001.

Operations Management Inc., 2001b, Operations and Maintenance Progress Report for the Marshall/Boulder Landfill Remediation Project, December 1, 2000 through May 31, 2001, prepared for City of Boulder and Browning Ferris Industries, July 9, 2001.

U.S. Environmental Protection Agency, 1986, Superfund Record of Decision: Marshall Landfill, CO, September 26, 1986.

U.S. District Court for the District of Colorado, Civil Action No. 99-Z-1714, U.S. of America vs. Landfill, Inc.; City of Boulder and others, Consent Decree. March 1989

U.S. Environmental Protection Agency, Explanation of Significant Differences, Marshall/Boulder Landfill Superfund Site, November 1992.

U.S. Environmental Protection Agency, 1993, Preliminary Site Close-out Report, Marshall/Boulder Landfill Site, Boulder County, Colorado, August 24.

ATTACHMENT 3

INTERVIEW RECORDS

OSWER No. 9355-7—03B-P

INTERVIEW RECORD

Site Name:	Marshall Landfill	**EPA ID No.:**	__COD 980499255__
Subject:	Second Five-Year Review	**Time:**----	**Date:** 8/23/01
Type:	☒ Telephone ☐ Visit ☐ Other	☐ Incoming	☒ Outgoing
Location of Visit:			

CONTACT MADE BY:

Name: K. Tegtmeyer	**Title:** Project Manager	**Organization:** MFG, Inc.

INDIVIDUAL CONTACTED:

Name: James Cohig		**Title:** Property Owner		**Organization:** Cowdery Corporation
Telephone No.:	(303) 765-2228	(303) 388-5531	**Street Address:**	
Fax No.:			**City, State, Zip:**	
E-Mail Address:				

Summary Of Conversation

1. **Do you have any concerns regarding the Marshall Landfill site or its remedy operations? If so, please detail.**

   Would be very happy to have water treatment end and have site removed from NPL.

2. **Are you aware of any events, incidents or activities at the site that concern you (or your department)? If so, please detail.**

   Approximately three years ago was approached by PRPs with proposal to change plant discharge from surface discharge to subsurface discharge. Nothing ever came of this inquiry.

3. **What is your overall impression of the remedial actions performed and their operation and maintenance?**

   Good job by PRPs.

4. **Do you feel informed about the activities at the site and progress made in the last five years?**

   Yes

5. **Do you have any comments, suggestions, or recommendations regarding the site's long-term management? If so, what types of future problems do you think either (1) could occur; or (2) would concern you at this site?**

   No plan to sell land at this time – plans to pass land along to children or sell to developer or sell to County for Open Space.

Other Comments:

As landowner, he will be happy when the site is no longer a designated Superfund Site. Requested copy of first five-year review, and next (second) five-year review report.

OSWER No. 9355-7—03B-P

INTERVIEW RECORD

Site Name:	Marshall Landfill			**EPA ID No.:**	COD 980499255
Subject:	Second Five-Year Review			**Time:**	**Date:** 8/23/01
Type:	☒ Telephone	☐ Visit	☐ Other	☐ Incoming	☒ Outgoing
Location of Visit:					

CONTACT MADE BY:

Name: K. Tegtmeyer	**Title:** Project Manager	**Organization:** MFG, Inc.

INDIVIDUAL CONTACTED:

Name: Fonda Apostolopoulos	**Title:** Project Manager *	**Organization:** CDPHE
Telephone No.: **Fax No.:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

1. **Are you aware of any departmental (CDPHE) concerns regarding the Marshall Landfill site or its remedy operations? If so, please detail.**

   No. None.

2. **Are you aware of any events, incidents or activities at the site that concern you (or your department)? If so, please detail.**

   Nothing happening in last several years. No concerns.

3. **What is your overall impression of the remedial actions performed and their operation and maintenance?**

   Based on data reviewed in ongoing monitoring reports, it appears that there is no significant contamination in water that flows to the treatment system. At this time the treatment system is "basically treating hard water" for constituents such as iron and manganese.

4. **Do you feel informed about the activities at the site and progress made in the last five years?**

   Yes. Receives and reviews routine monitoring reports.

5. **Do you have any comments, suggestions, or recommendations regarding the site's long-term management? If so, what types of future problems do you think either (1) could occur; or (2) would concern you at this site?**

   Ongoing monitoring should be adequate to address concerns for contamination. Expects that site can be delisted within next several years. No concerns for future problems.

* Involved last few years but not during remedy development.

CONTACT MADE BY:

Name: K. Tegtmeyer **Title:** Project Manager **Organization:** MFG, Inc.

INDIVIDUAL CONTACTED:

Name: Fonda Apostolopoulos **Title:** Project Manager * **Organization:** CDPHE

Summary Of Conversation (Continued)

6. Other Comments

Agrees that changes in water quality standards should be identified in five-year review but felt that parameters with lowered standards are not likely to be contaminants present in groundwater/surface water at

OSWER No. 9355-7—03B-P

INTERVIEW RECORD

Site Name:	Marshall Landfill	**EPA ID No.:**	COD 980499255
Subject:	Second Five-Year Review	**Time:**	**Date:** 8/23/01
Type:	☒ Telephone ☐ Visit ☐ Other	☐ Incoming	☒ Outgoing
Location of Visit:			

CONTACT MADE BY:

Name: K. Tegtmeyer	**Title:** Project Manager	**Organization:** MFG, Inc.

INDIVIDUAL CONTACTED:

Name: Jeff Zayech	**Title:** Environmental Health Program	**Organization:** Boulder Co. Dept. Health	
Telephone No.: (303) 441-1182		**Street Address:**	
Fax No.:		**City, State, Zip:**	
E-Mail Address:			

Summary Of Conversation

1. **Are you aware of any community concerns regarding the Marshall Landfill site or its remedy operations? If so, please detail.**

   No. One phone call in last five years regarding conditions at the site and its remediation status since selection of remedy.

2. **Are you aware of any events, incidents or activities at the site that concern you (or your department)? If so, please detail.**

   No.

3. **What is your overall impression of the remedial actions performed and their operation and maintenance?**

   No issues with remedy.

4. **Do you feel informed about the activities at the site and progress made in the last five years?**

   Not personally well informed, but the Department receives annual reports (at Solid Waste Division) that are available for reference, if needed.

5. **Do you have any comments, suggestions, or recommendations regarding the site's long-term management? If so, what types of future problems do you think either (1) could occur; or (2) would concern you at this site?**

   Ongoing reviews should continue. Any residential or other development that disturbs landfill would be a concern if it were to occur in the future.

INTERVIEW RECORD

Site Name:	Marshall Landfill			**EPA ID No.:**	COD 980499255
Subject:	Second Five-Year Review			**Time:**	**Date:** 8/23/01
Type:	☒ Telephone	☐ Visit	☐ Other	☐ Incoming	☒ Outgoing
Location of Visit:					

CONTACT MADE BY:

Name: K. Tegtmeyer	**Title:** Project Manager	**Organization:** MFG, Inc.

INDIVIDUAL CONTACTED:

Name: Tom Fair	**Title:** Director of Public Works	**Organization:** City of Louisville
Telephone No.:	**Street Address:**	
Fax No.:	**City, State, Zip:**	
E-Mail Address:		

Summary Of Conversation

1. **Are you aware of any community concerns regarding the Marshall Landfill site or its remedy operations? If so, please detail.**

   Occasional calls from individuals with questions about possible impacts of site on drinking water quality. City tells them that they have not seen any problems with water quality originating at site and have monitoring data to confirm that drinking water contamination is not occurring.

2. **Are you aware of any events, incidents or activities at the site that concern you (or your department)? If so, please detail.**

   No. No need to interact with project activity in last several years.

3. **What is your overall impression of the remedial actions performed and their operation and maintenance?**

   Assuming operation is performing as intended.

4. **Do you feel informed about the activities at the site and progress made in the last five years?**

   Not well informed. Groundwater quality reports have not been provided recently. Would like to receive offsite groundwater and surface water monitoring data more frequently, and requested copy of five-year review report.

CONTACT MADE BY:

Name: K. Tegtmeyer	**Title:** Project Manager	**Organization:** MFG, Inc.

INDIVIDUAL CONTACTED:

Name: Tom Fair	**Title:** Director of Public Works	**Organization:** City of Louisville

Summary Of Conversation (Continued)

5. Do you have any comments, suggestions, or recommendations regarding the site's long-term management? If so, what types of future problems do you think either (1) could occur; or (2) would concern you at this site?

City of Louisville occasionally takes deliveries of water via open ditch (Community Ditch) east of 66th Street.

Primary long-term concern is maintenance associated with pipeline:

(1) Ensure water quality not impacted;
(2) Ensure that conditions at site do not accelerate pipeline degradation.
(3) Landfill conditions not contributing to pipeline degradation.

INTERVIEW RECORD

Site Name:	Marshall Landfill			**EPA ID No.:**	COD 980499255
Subject:	Second Five-Year Review			**Time:**	**Date:** 8/23/01
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Location of Visit:					

CONTACT MADE BY:

Name: K. Tegtmeyer	**Title:** Project Manager	**Organization:** MFG, Inc.

INDIVIDUAL CONTACTED:

Name: Peter Fogg	**Title:** Manager of Long Range Planning	**Organization:** Boulder County Land Use Department
Telephone No.: **Fax No.:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

1. (If appropriate) Has the presence of this site had any impact on land use in the area? In the surrounding community?

At this time, there is no development activity that he is aware of at or surrounding the site. Intergovernmental agreement is in place with Superior to prevent development of this area (i.e., future residential and commercial uses not allowed).

The site has "rural preservation status" which is to be maintained by Boulder County.

2. Do you have any comments, suggestions, or recommendations regarding the site's long-term management? If so, what types of future problems do you think either (1) could occur; or (2) would concern you at this site?

Special recreational uses may be allowed in the future but would be subject to review and approval by Boulder County Commissioners and a Public Hearing process – consistent with County zoning regulations.

INTERVIEW RECORD

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Subject:	Second Five-Year Review	**Time:**	**Date:** 8/23/01
Type:	☒ Telephone ☐ Visit ☐ Other	☐ Incoming	☒ Outgoing
Location of Visit:			

CONTACT MADE BY:

Name: K. Tegtmeyer	**Title:** Project Manager	**Organization:** MFG, Inc.

INDIVIDUAL CONTACTED:

Name: Bruce Williams	**Title:** Town Manager	**Organization:** Superior	
Telephone No.: (303) 499-3675 **Fax No.:** **E-Mail Address:**		**Street Address:** **City, State, Zip:**	

Summary Of Conversation

1. **Are you aware of any community concerns regarding the Marshall Landfill site or its remedy operations? If so, please detail.**

   No.

2. **Are you aware of any events, incidents or activities at the site that concern you (or your department)? If so, please detail.**

   No.

3. **What is your overall impression of the remedial actions performed and their operation and maintenance?**

   Not knowledgeable regarding these actions so not able to comment. Even so, "no news is good news."

4. **Do you feel informed about the activities at the site and progress made in the last five years?**

   No; would like to be better informed. Requested a copy of the five-year review report.

5. **(If appropriate) Has the presence of this site had any impact on land use in the area? In the surrounding community**?

   No development currently planned in the area. There is an inter-governmental agreement with County and City of Boulder not to develop surrounding area.

6. **Do you have any comments, suggestions, or recommendations regarding the site's long-term management? If so, what types of future problems do you think either (1) could occur; or (2) would concern you at this site?**

   Periodic reporting (every five years) to Superior would be helpful to inform new residents about the site.

CONTACT MADE BY:		
Name: K. Tegtmeyer	**Title:** Project Manager	**Organization:** MFG, Inc.
INDIVIDUAL CONTACTED:		
Name: Bruce Williams	**Title:** Town Manager	**Organization:** Superior

Summary Of Conversation (Continued)

Other Comments: There are still well water users in old town of Superior. Worst-case scenario would be for off-site contamination of groundwater that migrates in the direction of old Superior.